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THE FOSSIL PLANTS FROM VERO, FLORIDA

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The discovery of human remains associated with an extinct mammalian fauna at Vero, Florida, has excited a great deal of local and general interest, and various theories regarding the age of these remains and the manner of their occurrence have already been advanced, and admirable accounts of the local geology have been given by Sellards and others.[1] It is therefore unnecessary for me to repeat any of these details in connection with the present preliminary abstract of my study of the fossil plants.

Plant remains in the form of laminae of impure peat or scattered fruits, chiefly acorns, are present from the bottom to the top of the deposits overlying the shell marl which forms the base of the section. The lower sands (designated No. 2 by Sellards) have yielded no leaves and but few acorns, but the upper bed (Sellards, No. 3) contains many leaf layers alternating with sand laminae, and it is from the latter horizon that all of the plants enumerated in the following pages have been collected, with the exception of one species of acorn which is common to both beds.

Recent and extinct mammalian and other bones occur in both layers, and human remains are also found in both beds. After a thorough study of the local sections and the paleontologic evidence I am convinced that there is no hiatus between beds Nos. 2 and 3 and that there is no great difference in age from the bottom to the top of the section, although it records changing physical conditions and necessarily becomes gradually more and more recent as the top of the section is approached. The lower sand marks the recession of the sea in which the underlying shell marl was formed. The upper beds (No. 3) mark successive seasonal layers of valley filling in the narrow valley of a small stream. This stream was apparently always small, and the marvelous abundance of fossils at this one point seems to be due to a bar or sinkhole or similar cache formed near the junction of the two lateral branches which united near this point to form the main stream. The determinable plants are represented almost exclusively by fruits or seeds, as the leaves, with the exception of the coriaceous oaks, which are abundant, were too thoroughly decayed before they were buried to retain their identity.

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[1] E. H. Sellards, *Am. Jour. Sci.* (IV), XLII (1916), 1–18; *Eighth Ann. Rept. Florida Geol. Surv.*, 1916, pp. 122–60, Pls. 15–31; *Science*, N.S., XLIV (1916), 615–17; *Jour. Geol.*, XXV (1917), 4–24, Figs. 1–4; R. T. Chamberlin, *ibid.*, XXV (1917), 25–39, Figs. 1–9; T. W. Vaughan, *ibid.*, pp. 40–42; A. Hrdlička, *ibid.*, pp. 43–51, Figs. 1, 2; O. P. Hay, *ibid.*, pp. 52–55; G. G. MacCurdy, *ibid.*, pp. 56–62, Figs. 1–6.

The study of such remains is beset with many difficulties. The material has to be sorted without allowing it to dry. It then has to be impregnated with paraffin simultaneous with drying. Finally, identification is hampered by the lack of recent material for comparison, and when the material is identified the determination of the exact range of the still existing species·on which so much hinges is a matter of great uncertainty in the present state of our knowledge of plant geography. I am under obligations to, and take this opportunity of thanking, Mr. W. L. McAtee, of the Biological Survey, for determining five species of fruits for me.

The following plant species have been identified from the Vero deposits:

Pinus taeda Linné
Pinus caribaea Morelet
Pinus sp.
Taxodium distichum (Linné) Rich.
Carex sp.
Pistia spathulata Michx.
Seronoa serrulata (Michx.) Hooker
Sabal palmetto (Walt.) R. & S.
Myrica cerifera Linné
Leitneria floridana Chapman (?)
Quercus virginiana Mill.
Quercus Laurifolia Michx.
Quercus Chapmani Sargent (?)
Quercus brevifolia (Lam.) Sargent
Polygonum sp.
Magnolia virginiana Linné
Anona glabra Linné
Brasenia purpurea (Michx.) Caspary
Ilex glabra (Linné) A. Gray
Acer rubrum Linné
Zizyphus sp. (new species)
Vitis cf. rotundifolia Michx.
Vitis sp.
Benzoin cf. melissaefolium (Walt.) Nees
Viburnum nudum Linné
Viburnum cf. dentatum Linné
Xanthium sp.

The most abundant form in the preceding list is *Quercus laurifolia*, which is represented in the upper beds by leaves, cupules, and acorns and in the lower beds by cupules and acorns. It is still found growing in the Vero region, but is not nearly so abundant as far south as Vero at the present time as it appears to have been at the time the Vero deposits were laid down.

SUMMARY

The foregoing comprise more or less positively identified remains of twenty-seven species of plants. Nineteen of these have not been previously found fossil, while the following eight have already been discovered in Pliocene or Pleistocene deposits:

Pinus taeda
Taxodium distichum
Quercus virginiana
Magnolia virginiana
Brasenia purpurea
Acer rubrum
Zizyphus sp.
Viburnum nudum

The problem in so far as it relates to the evidence of the plants depends on the correct evaluation of the change which this plant assemblage shows when compared with the flora now growing at Vero.

Of the plants found fossil the following are still found at Vero, and I have included in this list as probably found in the present flora of Vero the four forms of *Pinus*, *Carex*, *Polygonum*, and *Xanthium* which are not specifically identified. This list comprises:

Pinus caribaea
Pinus sp.
Carex sp.
Serenoa serrulata
Sabal palmetto
Myrica cerifera
Quercus virginiana
Quercus laurifolia
Quercus brevifolia
Polygonum sp.
Magnolia virginiana
Ilex glabra
Acer rubrum
Vitis cf. rotundifolia
Xanthium sp.

In addition to the foregoing fifteen species still found at Vero the following two species are found growing within ten or twelve miles of Vero:

Taxodium distichum
Anona glabra

Three species approach to within about fifty miles of Vero, being recorded from the southern extension of the lake region flora of the central peninsula in De Soto County. These are:

Pinus taeda
Pistia spathulata
Viburnum nudum

The following six species are not now found growing in peninsular Florida:

Leitneria floridana (?)
Quercus chapmani (?)
Brasenia purpurea
Vitis sp.
Benzoin cf. melissaefolium
Viburnum cf. dentatum

Of these *Leitneria floridana* is a very local form not found nearer than the Apalachicola River, and the chief center of growth of *Quercus chapmani* is also in west Florida, while the true *Viburnum dentatum* does not occur nearer than the upland region of Georgia.

Finally, the Vero deposits have yielded a fruit probably identical with similar remains from the late Pleistocene of New Jersey representing an entirely extinct species of *Zizyphus*, a genus abundant in Southeastern North America during the Tertiary, but not now represented except by a single species of the arid southwest (Texas to Arizona).

Two of the fossil species have been recorded from the Pliocene. These are *Taxodium distichum* and *Magnolia virginiana*. One, *Quercus virginiana*, is found in the early Pleistocene of both Kentucky and Alabama, and the following occur in the late Pleistocene:

Pinus taeda
Taxodium distichum
Quercus virginiana
Brasenia purpurea
Acer rubrum
Zizyphus sp.
Viburnum nudum

These latter, while they constitute but 26 per cent of the known fossil flora at Vero, are especially significant in connection with the fact that they all occur elsewhere in the physiographically youngest of the Pleistocene terrace deposits, namely, the Talbot of New Jersey and Maryland, the Chowan of North Carolina, and the corresponding lowest terrace at several localities in Alabama, while the Vero deposits constitute the youngest physiographic terrace plain of the region and are referred to the Pensacola terrace by Matson.[1]

In my judgment and in the ordinary acceptance of that term this flora is unquestionably of late Pleistocene age.

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[1] G. C. Matson, *U.S. Geol. Surv., Water Supply Paper 319*, 1913, pp. 31–35.

Regarding its bearing on the interesting problem of the age of the human and associated mammalian and other remains at Vero, my study of the locality furnishes the following somewhat categorical conclusions. The underlying shell marl which forms a definite and undisputed datum plane is late Pleistocene in age. Its species all exist in near-by waters at the present time, and many of them have been recorded from shell marls found from southern New Jersey to the Florida keys and forming a part of the lowest and latest well-defined terrace plain previously mentioned as having been named Talbot in Maryland, Chowan in North Carolina, and Pensacola in Florida. It follows that the vertebrate remains which are so numerous at Vero cannot possibly be of Middle or early Pleistocene age unless they are regarded as having been reworked from older deposits, and I cannot conceive that this was possible, nor do the vertebrate paleontologists who have examined the deposits consider that such was the case. In fact, I believe that, if it had not been for the overestimate of the age of this vertebrate fauna, Dr. Chamberlin would not have advanced his hypothesis of the reworking and mechanical mixing of these bones and Dr. Hrdlička would not have insisted on the human burial theory to account for the presence of the human skeletal remains. Nothing is more reasonable than to suppose that the larger elements in the Middle Pleistocene fauna of more northern areas should have lingered for thousands of years in this more genial southern clime until the presence of man in considerable numbers and the changing climate as is attested by the fossil plants should have brought about the extinction of a large percentage of the fauna. The fauna itself confirms the rather limited data furnished by the fossil flora of this change in climate, since it indicates a more mesophytic habitat than exists today in the vicinity of Vero. Regarding the burial theory of Dr. Hrdlička it may be said that a part of the plant material came from immediately above one of the human skeletons, and I cannot conceive of the possibility of not being able to see evidence of artificial burial in material made up of alternate layers of sand and matted leaves and other vegetable débris. I therefore see no reason to doubt that relative modern men were contemporaneous with this partially extinct fauna of Middle Pleistocene aspect which survived in Florida to the late Pleistocene. With regard to the exact age of the Vero deposits there are, it seems to me, but two alternatives, and these apply equally and are in large part derived from a study of the physiography and the faunas and floras of the corresponding topographic forms in the other states of the Coastal Plain. These alternatives are that they are about the same age as the Peorian interglacial deposits of the Mississippi Valley or are immediately post-Wisconsin and correspond with what the Scandinavian geologists have named Litorina time.